ABDULLAH GÜL UNIVERSITY
GRADUATE SCHOOL OF ARCHITECTURE
COURSE DESCRIPTION AND SYLLABUS

Course Title	Code	Semester	T+L Hours	Credit	ECTS
KINETIC ARCHITECTURE, SHAPES AND SPACES	ARCH521	Fall	2 + 1	3	10

Prerequisite Courses	NONE

Type	Elective
Language	English
Coordinator	Valentina BEATINI
Instructor	Valentina BEATINI
Adjunt	None
Aim	The course addresses the issues of adaptable and transportable spaces and gives the knowledge to create architectural solutions that can mediate both in time and in space their presence. This will be achieved having the following goals. G01. To transmit sufficient theoretical background to the students, so that they can deal with the mechanical approach to kinematic design G02. To exercise students to critically valuate different options to put in practice the kinematic principles. G03. To allows students experiencing kinetic architecture, through physical and digital models. G04. To brings the students to kinematic design a modular mechanism that fulfils the needs of an adaptable or transportable space G05. To discover new opportunities for kinetic architecture through an increased spatial consciousness.
Learning Outcomes	LO1. To know the basic concepts of kinematic design and correctly use their terminology. L02 To develop the relationship between architectural and kinematic problem definition. L03 To set the relationship between architectural requirements and kinematic tasks, adopting the architectural functional requirements and space constraints within the kinematic synthesis of mechanisms. L04 To design a modular mechanism to achieve the desired task, analyzing its position over time. L05 To think on architectural problems considering transformable and/or transportable solutions.
Course Content	The course focuses on kinematic – transmission of motion between rigid bodies –and deepens gradually the well-established mechanical knowledge as interpretations of spatial design requirements. From the kinematic analysis on planar, spherical and spatial linkages, to the investigation into geometry and configuration of folded plate structures, students will be engaged into the creative design of kinetic architectural applications.

WEEKLY TOPICS AND PRELIMINARY STUDY

Week	Topic	Assigned study-work
1	Workshop. Foldable Pavilions	
2	Introduction. Basic definitions. Kinematic and architectural problem definition	Exercise 1. Architectural description of kinetic architectures
3	Kinematic synthesis	Exercise 2. Kinetic identification of kinetic architectures
4	Degrees of freedoms and types of joints	Exercises 3. Counting the degree of freedom.
5	Lecture free. Experience different types of mechanisms	In class Exercise 4. Design a kinetic sculpture
6	Degrees of freedoms and types of joints	Exercises 3. Counting the degree of freedom.
7	Position analysis and vector loop equation	Exercise 5: reproduce an existing 4-bar mechanism for architectural applications through a physical model

8	Position analysis and vector loop equation	Exercise 6: create a physical model of a 4-bar mechanism for furniture or façade
	Middle jury	Final submission of exercises 1, 2, 4, 5.
9	Introduction to mechanical design software for kinematic design. Hands on	Exercise 6: Draw the mechanism of design 5 with software, animate.
10	Scissor mechanisms	Selected readings from literature
11	Transformable scissor mechanisms	Exercise 6: make a scissor modular mechanism for architectural applications
12	Spherical mechanisms	Selected readings from literature
13	Spherical mechanisms, Degrees of freedoms and intro to position analysis	Readings from literature, selected with the students
14	Review of projects	Exercise 7. Make a plate mechanism to create an architectural space
	FINAL EXAM	Final submission of exercises 6 to 7

SOURCES	
Lecture Notes	Lecture notes and slides
Other Sources	**Course learning sources:** • Norton, Robert L, Design of Machinery. New York, Mcgraw Hill, 3rd ed., 2003, Ch. 1-3. • Söylemez ,Eres, Mechanisms, METU, Ankara, 1979 (also available in Turkish) **Additional Materials:** • Panoramic of origami and folded plates research trends trough Flickr web hosting site. URL: www.flickr.com/ Primarily Ray Schamp's photo stream, and then Thomas Hull (alias tomster0) Eric Gjerde, Polly Verity (alias polyscene), Philip Chapman-Bell (alias oschene) • Animation of simple mechanisms, especially linkages, can be found at: URL: www.mekanizmalar.com/ **Optional readings:** Laurence, Paul. Folding Techniques for Designers. London, Laurence King Publishing, 2011. Gantes, Chars J., Deployable Structures: Analysis and Design, Southampton, U.K. WIT Press, 2001.

COURSE MATERIALS SHARING	
Documents	Lecture notes and slides
Homeworks	Students will be given 10 analytical or simulation homework. Exercises from 4 to 10 will be criticized during the lessons and graded at the exams
Exams	1 Midterm and 1 Final presentations

EVALUATION SYSTEM		
SEMESTER STUDY	**NUMBER**	**CONTRIBUTION**
MIDTERM, exercises 4 to 6	1	35
Homework, exercises 1 to 3	3	10
FINAL EXAM exercises 7 to 10	1	55
TOTAL		100

Course Category	
Architecture	45%
Engineering, mechanical	55%

RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS							
No	Program Qualifications	Contribution Level					
		1	2	3	4	5	
2	To explore architectural issues critically by relating architecture to other disciplines and to present creative proposals to develop them					x	
4	To present creative and leading proposals to solve problems by being aware of current debates and problematics in the field of architecture.				x		
7	To analyze the research topic by looking at the field, interpret individually, propose solutions and have responsibility in the construction phase			x			
10	To evaluate the current developments in the architectural field by considering scientific and ethic values, to be able to express individual studies systematically.		x				

14	To criticize basic concepts of architecture; to consider, interpret and present the relation between architecture and other disciplines.					x
15	To design architectural project conceptually, to see its qualities and to develop it to reach the application and construction phase.			x		

*Increasing from 1 to 5.

ECTS / WORK LOAD TABLE			
Activities	Number	Duration (Hours)	Total Work Load
Course Length (includes exam weeks: 15x total course hours)	15	3	45
Out-of-class Study Time (Pre-study, practice)	15	3	45
Internet search, library work, literature search	15	1	15
Homework	10	18	180
Midterm	1	8	8
Final Exam	1	8	8
Total Work Load			301
Total Work Load / 30			301/30
Course ECTS Credit			10